1. CRITICAL EXPONENTS . . . . . .

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Systems which undergo a second-order phase transition at some critical temperature T_c have thermodynamic behaviour which can be characterized by a small set of numbers, the critical exponents. For example, consider the correlation length ξ, the typical distance between which the system's degrees-of-freedom are correlated. As the temperature approaches T_c, the correlation length diverges as $\xi \sim |T - T_c|^{-\nu}$ where $\nu > 0$ is the correlation length critical exponent. One remarkable fact is that disparate systems have critical behaviour described by the same values of critical exponents. We say these systems fall into the same universality class.

Write an essay introducing and reviewing critical phenomena, specifically critical exponents. The essay should discuss upon how these exponents can be computed in Landau-Ginzburg theory and beyond.

Prof Horgan's lecture notes for the Part III course in Statistical Field Theory (not given this year) are a good place to start reading. However the successful essay should be more than a recapitulation of sections of these notes.

Relevant Courses

Useful: undergraduate statistical physics

References

[1] R R Horgan, Statistical Field Theory lecture notes,
`http://www.damtp.cam.ac.uk/user/rrh/`.

[2] J. J. Binney, N. J. Dowrick, A. J. Fisher, and M. E. J. Newman, *The Theory of Critical Phenomena*, Oxford University Press, 1992.

[3] M Kardar, *Statistical Physics of Fields*, Cambridge University Press, 2007.

[4] Shang-keng Ma, *Modern Theory of Critical Phenomena*, W. A. Benjamin, 1976.